STAs take into account the most recent traffic situation. This periodic update approximately corresponds to the rate at which aircraft-track updates are received. In addition, manual inputs by the TMCs, such as scheduling constraints, sequence constraints, and changes in the airport configuration, will trigger the DP to compute a new set of STAs and runway assignments to accommodate these changes.

The DP, as part of the TMA, has been in daily operational use throughout 1997 at the Traffic Management Unit at the Fort Worth Air Route Traffic Control Center. Feedback from TMCs, air traffic controllers, and researchers has defined new requirements that were unknown during the initial analysis and design phase. Because of the object-oriented design approach, however, these changes were quickly incorporated into the DP without disrupting its daily use.

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Daily Use of the Traffic Management Advisor

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The growth of commercial air travel and the "hub-and-spoke" operations used by many air carriers have put a severe strain on the Nation's air traffic capacity. This strain is safely, but many times inefficiently, absorbed by routine airborne and ground delays of aircraft. These delays cost the traveling public several billion dollars per year. The Center/TRACON (Terminal Radar Approach Control) Automation System (CTAS) is a joint NASA/Federal Aviation Administration (FAA) program that has as its goal the development of decision-support automation tools to efficiently reduce delays while maintaining a safe and reasonable level of controller workload.

The Traffic Management Advisor (TMA), developed under the CTAS program, is a time-based strategic planning and tactical advisory tool for traffic management coordinators and en route air traffic controllers. The TMA assists these air traffic control (ATC) specialists in efficiently and safely optimizing the capacity of a demand-impacted airport. The TMA software consists of highly accurate trajectory prediction, safety and ATC constraint-based scheduling with fuel-efficient delay distribution, traffic flow visualization, and controller advisories.

The TMA was installed and evaluated during a limited operational assessment in the summer of 1996 at the Fort Worth Air Route Traffic Control Center (ARTCC) and the Dallas/Fort Worth (DFW) Terminal Radar Control Facility, two of the busiest ATC facilities in the world. The benefits demonstrated during the assessment indicated that routinely the TMA saves 2 minutes of delay for every aircraft and, because of its efficient delay distribution scheduling, the routine landing capacity of the DFW TRACON was increased by 5%.

Following the success shown by the initial assessments, the FAA requested that NASA maintain the TMA on a daily use status throughout 1997. The figure shows the TMA as installed in the Traffic Management Unit at the Fort Worth ARTCC. The objective of this research was to expose the TMA to the broad spectrum of ATC personnel, as well as to

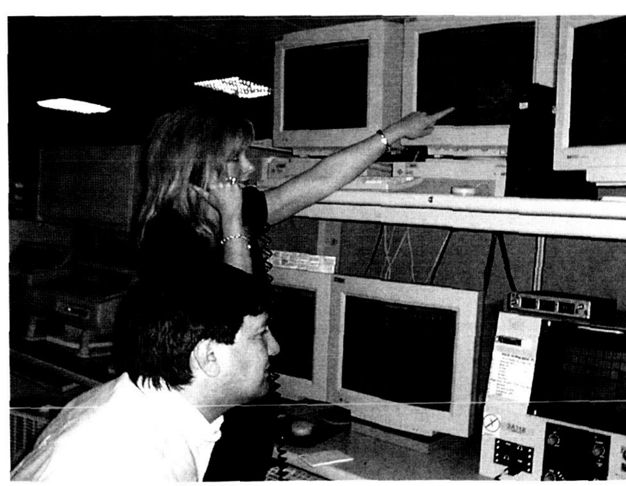

Fig. 1. Traffic Management Advisor installation at Fort Worth ARTCC.

the broad range of ATC conditions that could not be captured during the initial assessment. The TMA, used as the primary traffic management tool throughout the year, yielded an estimated annual savings of $5.6 million as a result of reduced delays. The evaluation during this extended period led to significant redesign of the configuration, scheduling, and mode-control interfaces, which reduced the workload associated with the use of the TMA. Another feature developed during FY97 to reduce controller workload was an automated delay-reporting system that for the first time provided the ATC facilities with a tool that accurately measures their performance. The TMA was also exposed to numerous anomalous events and provided the means to quickly provide solutions so that at the end of the year, the FAA had changed its acquisition strategy from one of a long-term development to a spiral deployment of the NASA prototype.

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Surface Movement Advisor

Stan Harke

The Surface Movement Advisor (SMA) is a joint Federal Aviation Administration (FAA) and NASA project whose purpose is to help current airport facilities operate more efficiently. Currently installed and operational at Atlanta-Hartsfield International Airport, SMA is demonstrating how advanced information systems technologies can be implemented to improve coordination and planning of ground airport traffic operations.

The SMA system is based on a client-server architecture. A fiber backbone between the airlines, the airport management, the ramp towers, and the FAA control tower links the SMA system together. Various traffic data are collected in real time by the SMA server. The SMA system integrates the airline schedules, gate information, flight plans, radar feeds, and runway configuration (departure split and landing direction). This integrated information is then retransmitted over the network system and shared between ramp operators, airport managers, airline operators, and FAA controllers and supervisors.

SMA provides air traffic and ramp controllers with automated aircraft identification and tracking. It combines tracking and identification data with arrival and departure flight-sequencing data (such as the surface operations and aircraft taxi routing information provided to air traffic controllers, airline operators, and airport operators).

The first SMA proof-of-concept/prototype (Build-1) has been successfully demonstrating SMA functional capabilities at the FAA-selected test site, Atlanta-Hartsfield International Airport, since early 1996.

An official report released by the FAA in October 1997 measured the cost benefit of the SMA in Atlanta conservatively at $20 million a year. The total investment was $4.1 million with a development time of only 18 months. This cost benefit was measured based on taxi times and for departures only. The report also cites benefits not quantified, including increased airline productivity, assistance to ground and ramp controllers in reduced visibility, and reduced communication time between tower and ramp, and between tower and pilots.

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